IFW

OIPE IAP12 JUL 02 2007 PATENT & TRADEMARK OFFICE

Petroleum Composites

1 Berryfrost Lane, The Woodlands, TX 77380
Phone: 281 296-0005 E-mail: pcomp@peoplepc.com

June 30, 2007

Appl. No.	:	10/764,634
Confirmation	:	No. 9083
Applicant	:	Jerry Gene Williams
Filed	:	1/23/2004
Examiner	:	Juan D. Valentin

Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Subject: Patent Application No. 10/764,635

Dear USPTO Representative:

Please find attached completed copies of Form PTO-1449 containing a list of patents and references cited in the subject patent application and copies of the cited references.

I have also found a few mistakes and typo errors in the specification submitted on March 26, 2007 which are listed below. I request that these changes be made in the final patent publication. I have also enclosed a CD of the specification which includes these changes in two different formats. One is a clean copy, the other is with changes including tracking.

Please make a correction to paragraph [0006] as shown in yellow below:

[0006] One very effective way of monitoring structural performance is to measure the strain response to load. Strain can be compared to design predictions and monitoring the change in strain during service can be a very effective indicator of structural degradation due to overload, impact, environmental degradation or other factors. Advanced fiber optics technology is a reliable in situ method not only to measure peak strain values but bending strain information can; ~~F~~for example, ~~the method can~~ be used to measure the magnitude, period, and frequency of Vortex Induced Vibrations (VIV) of risers used in offshore petroleum drilling and production operations; and more particularly, through engineering interpretation of the bending strain data to predict the fatigue life of the tubular and to allow active controls to be used to mitigate the potential damage from VIV. In addition, the fiber optics system can provide bending strain information which can be used to predict the life of spoolable pipe and the onset of buckling induced lock-up during deployment into a small diameter annulus. ~~be used to determine the vibration response imposed during dynamic loading such as by Gulf of Mexico loop currents.~~ Bending strain is represented by the difference in the strain along the longitudinal axis measured at opposite ends of an imaginary line drawn perpendicular to the longitudinal axis of the long slender structure and through the structure centroid. The maximum bending strain occurs on an

axis perpendicular to the structure longitudinal axis and perpendicular to the axis of zero bending strain. Fiber optics technology including Optical Time Domain Reflectometry (OTDR), Optical Frequency Domain Reflectometry and Bragg defraction grating methods are ideally suited for in situ measurement of strain in long slender structures. Bragg gratings are particularly valuable for making local strain measurements while the Optical Time Domain Reflectometry method is ideally suited for making global strain measurements such as the average strain over the length of a riser or several risers.

Please add a zero to made a decimal change to (0.0001) in paragraph [007] as shown marked in yellow below.

[0007] OTDR <u>is a time of flight method which</u> measures spatial positions along an optical fiber by launching brief pulses of laser light into one end of the fiber and then detecting the subsequent reflections at reflective interfaces inserted along the length of the fiber. The principles of the use of optical fibers technology to measure strain are well established. Discussion of OTDR principles can be found in the following reference, which is incorporated herein by reference: M. K. Barnoski, M. D. Rourke, S. M. Jensen, and R. T. Melville: "Optical Time Domain Reflectometer," Applied Optics, Vol. 16, No. 9. September 1977. The optical fiber is rigidly attached to the long slender structure and thus experiences strain identical to that imposed on the structure. By measuring the transit time of the reflected pulses and by knowing the speed at which light travels in the optical fiber, a very accurate measure of the distance to each reflective interface can be obtained. As the gauge section defined as the length between two reflective interfaces placed within the optical fiber undergoes strain, the interface's spatial position along the fiber changes and the OTDR measurement of this change in length is a direct measurement of the average strain in the structural component. An OTDR with a picosecond pulsed light source can measure a change in length as small as 0.4-inch with an accuracy of about +-.0.001 inch. A change in length of 0.4 in a 70-ft riser converts to a strain of 0.05%.+-.0.0001%, which is sufficiently accurate to measure strains in the expected range of 0.07%. If needed, the accuracy can be increased in the riser application by making more than one traverse loop along the length of the pipe and thus provide a longer gage length. A single optical fiber can be used to measure strains at more than one location by imposing multiple reflective surfaces along the length of the optical fiber in combination with customized software algorithms to measure strain between each adjacent reflective interface. Measurement of the longitudinal strain in a long slender structure provides valuable information about the state of the "fitness for service" when compared to design allowables and expected conditions.

Please made the following corrections and deletions from Par. [0040 A]. The major deletion is a typo mistake of an unwanted insertion of Par. [0036 A].

[0040 A] The optical fibers are rigidly attached to the long slender structure by the bonding agent and additional protection can be provided by a secondary outer protective layer such as is typically required for other purposes including sealing a composite tube laminate against fluid intrusion. ~~, and~~ The optical fiber leads from the end of the gage section into a central fiber Optics Connection Box 20 should be isolated again strain since it is important not to impose strain in the optical fiber outside the gage section and it can be provided protection by insertion into a carrier tube. For application of the bending strain measurement system for dynamic characterization of ropes and cables, the preferred method is to integrate the optical fibers into the

construction of the rope or cable during manufacture. One method is to place the optical fiber on or near the outer surface of the rope or cable and overlay a protective braid or polymeric coating as is a common practice in rope and cable construction to protect the rope or cable. The outer braided cover commonly used in the construction of large diameter mooring ropes deployed for station keeping on offshore platforms is tightly applied and will provide sufficient friction during loading to impose upon the axial optical fiber near identical axial strain to that experienced by the rope.~~[0036 A] Further referring to FIG. 3, which provides a schematic view illustrating coiled tubing equipment deploying Spoolable Pipe 42 from a Storage Spool 44 into a Small Diameter Annulus 50. The Coiled Tubing Injector 40 grips the Spoolable Pipe 42 controlling the descent during insertion into the predrilled low friction vertical section of the Small Diameter Annulus 50. As the Small Diameter Annulus 50 deviates from vertical and frictional forces exceed the weight of the Spoolable Pipe 42 suspended in the Small Diameter Annulus, the Coiled Tubing Injector 40 applies compressive force onto the Spoolable Pipe 42 to force it further into the Small Diameter Annulus 50. The Small Diameter Annulus 50 is typical created by a Mud Motor Drilling Tool 46 driven by the circulation of mud under high pressure which flow down the Spoolable Pipe 42 and back to the surface in the space between the Spoolable Pipe 42 and the Small Diameter Annulus 50. Extension of the length of the Small Diameter Annulus 50 is accomplished by the rotary action of the drill bit of the Mud Motor Drilling Tool 46 as it breaks up the earth formation. The compressive force of the drill bit upon the formation required for drilling is created by the pushing force of the Coiled Tubing Injector 40 and the weight of the Spoolable Pipe 42 suspended in the vertical portion of the Small Diameter Annulus 50. Small particles broken from the formation are carried to the surface with the circulation of the drilling mud. It is common practice in modern petroleum drilling operations to extend a Small Diameter Annulus 50 from a vertical into a deviated or horizontal direction as illustrated in FIG 3. As the horizontal portion of the Small Diameter Annulus 50 grows relative to the vertical portion, greater frictional forces are developed and the Coiled Tubing Injector 40 must apply increasing greater compressive force on the Spoolable Pipe 42 to advance the Mud Motor Drilling Tool 46 further into the Small Diameter Annulus 50. A stability condition develops in which the Spoolable Pipe 42 begins to buckle in the Small Diameter Annulus 50. As greater and greater compressive forces are applied, the Spoolable Pipe 42 buckles in a Spiral or Helical Buckle 48 illustrated in FIG 3. As greater and greater compressive force is applied and more and more friction is developed, a buckling condition is reached at which the force required to retract the pipe back out of the Small Diameter Annulus 50 are greater than the pulling force capability of the Coiled Tubing Injector 40 or the strength of the Spoolable Pipe 42 and a condition of lock-up occurs. Coiled tubing Lock-up is a serious problem and preventive efforts are important to avoid this condition.~~

Thank you for your efforts in making the review of my patent application.

Sincerely,

Jerry Gene Williams

Jerry Gene Williams, Ph.D., P.E.